SYNERGETIC
SYN AUD CON
AUDIO CONCEPTS

P. O. BOX 1115, SAN JUAN CAPISTRANO, CA

newsletter

VOLUME 7, NUMBER 2
WINTER, 1980

SYNERGETIC
Working together; co-operating, co-operative

SYNERGISM
Co-operative action of discrete agencies such that the total effect is greater than the sum of the two effects taken independently.

EXCHANGE OF IDEAS

I met a man with a dollar
We exchanged dollars
I still had a dollar

I met a man with an idea
We exchanged ideas
Now we each had two ideas

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SYN-AUD-CON OFFICE AND LAB TO MOVE TO THE MOUNTAINS

We live in the heart of a 47,000 acre wilderness in a national forest in Southern California. Our small (less than 50 families) 250 acre community of small horse ranchos is nestled in a valley on top of some of the foothills adjacent to the main peaks in the range. Recently, the opportunity presented itself for us to obtain some adjacent ranching property that allows us to build an office and laboratory on it. We'll be writing more about this property in the future. The transfer of office and laboratory will be accomplished during the next six months. The new address - beginning in January - is: SYN-AUD-CON
P. O. Box 1115
San Juan Capistrano, CA 92693

While our old address will also be maintained during the transfer period, you are assured of the quickest response from us by using the new address.

MA BELL SOLVES SYN-AUD-CON COMMUNICATION PROBLEM

What has made Syn-Aud-Con's office move into the mountains a reality is "Ma Bell's" investment of $300,000 in a unique new carrier system and a seven mile 400 pair buried cable into our isolated community. Bell's engineering for this job was spectacularly well done - from ditching along side a one-lane mountain road with 1500 ft. unguarded drops into the canyons to firing up a new electronics system at the foot of the mountain and having it work the first time.

The 19 gauge pairs required "loading coils" at various points along the seven miles of private road leading from the gate to our community as we are voice frequency over the cable. The carrier system at the gate interfaces our 400 lines to the 25 trunks available along the public highway leading through these mountains. Most callers have remarked on the excellent transmission quality.

We are still undergoing the psychological change of not having to drive an hour to the office in order to make a phone call. We still make statements like,"Let's see. I'll be in the office on Friday and I'll call you then."

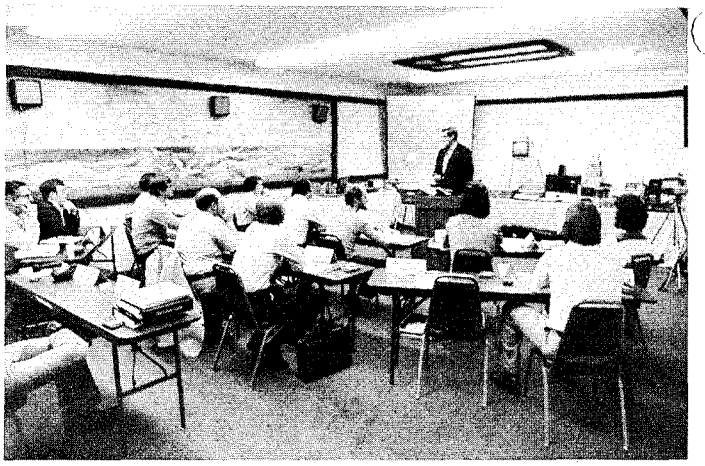
SYN-AUD-CON's NEW TELEPHONE NUMBER
714-496-9599

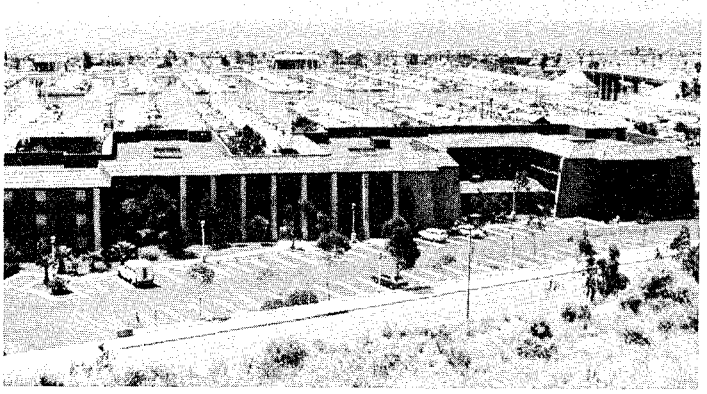
We still maintain 714-838-2288. Patti is in the Tustin office. Try the 496-9599 first. If you can't reach us there, call the Tustin number.

WHAT'S DIFFERENT ABOUT SYN-AUD-CON CLASSES IN CA?

One big difference is pictured here - the class walking along the Marina in the warm California sun on the way to lunch and dinner each day.

The small size of the classes. We currently have been keeping classes to less than 15 participants. We will increase the size again in the future but our Winter-Spring schedule will provide the bonus of small, intimate, very personal classes.





As the winter *wears* on in time and toil, consider the idea of sharing three days of intensive, interesting audio exploration with us in Southern California. We're looking forward to having you here.

CROWN TO MANUFACTURE PZM™ SYSTEMS

Crown International of Elkhart, Indiana now holds exclusive license for the manufacture of PZM™ systems. Syn-Aud-Con, under its agreement with E. M. Long Associates, granted this license effective as of the first of the year.

Ken Wahrenbrock has accepted a consulting contract with Crown to assist them in the marketing of present models and the development of future models. Ken also will serve as one of their distributors so that he can continue to service the needs of Syn-Aud-Con graduates who are not Crown dealers.

Pre-production models of the Crown pressure zone microphones are currently being assembled in Elkhart, Indiana. Plans call for continuous assembly over the next sixteen weeks so that a supply of all models will be available for shipment beginning May 1, 1980.

Crown's dealer agreement for pressure zone microphones will be separate from that of other Crown products. However, the company's Professional and Distinction Series dealers will initially be offered the Crown PZM™ line.

KEN WAHRENBROCK, builder
inventor, instructor

For further information from Crown contact:

Mr. Murray Young
Marketing Communications
Crown International, Inc.
1718 West Mishawaka Road
Elkhart, IN 46514 Tele: 219-294-5571

Syn-Aud-Con is extremely pleased to see this most worthwhile audio advance pass into the hands of such a superb manufacturer. We are especially optimistic about the product possibilities with Ken Wahrenbrock working on a new model of this unique microphone system technology.

66TH AES CONVENTION IN LOS ANGELES

I have often wondered why people accept the job of Chairman of various functions. I got some insight into why--at least why I accepted Chairmanship of the AES Convention. I wanted it done *my way*. Next year they can go back to doing it the same old way, but this year, it's my way. I have a couple of real gripes, the main one being the Friday afternoon technical sessions. *This year* there will be no Friday afternoon technical sessions. It is worth the work of Chairmanship for this one reason only. It is sort of a several-years-late apology to Ed Long. A few years ago he gave what we felt was the most important paper of the AES on Friday evening at 5:30 (after the Convention had closed and exhibits were breaking down) to about 20 people. Fortunately, Bill Putnam, owner of United Recording of which UREI is a part, was in that small audience. Now the industry has the UREI 813 Time Align Studio Monitors.

There will be a few other changes, I hope all good. There are a lot of our good friends working to make it good.

Larry Estrin is putting together an outstanding banquet program; Rick Blunt of Rauland is Facilities Chairman; Jean Estrin (Mrs. Bobby Estrin) is Social/Cultural Chairman; David Brand will arrange a tour of recording studios; Ken Wahrenbrock is Assistant Chairman; and Glen Ballou is Papers Chairman.

For our technical sessions we have the following Chairmen:

Transducer Applications:	Manny Mohageri, Emilar Corporation, Anaheim, California
Computer/Calculator Applications in Audio:	Gerald Stanley/Dave McLaughlin, Crown International, Elkhart, Indiana
Magnetic and Disk Recording:	Joe Martinson, Martinsound Studios, Alhambra, California
Studio Technology:	Chips Davis, Las Vegas Recording, Las Vegas, Nevada
Women in Audio:	Mary Gruszka, CBS TV Network, New York, New York
Instrumentation Update:	James Moir, James Moir and Associates, Chipperfield, Great Britain Co-Chairman, Brian Larson, Ivie Electronics, Orem, Utah
Motion Picture Sound:	Ted Uzzle, Cambridge, Massachusetts
Signal Processing:	Mahlon Burkhard, Industrial Research Products, Inc., Elk Grove Village, IL
Electroacoustics, Acoustics, and Psychoacoustics:	Victor Hall, Communications Company, San Diego, California
Electronic Music for the User:	James A. Moorer, Stanford University, Stanford, California

There were some adverse comments about the "Women in Audio" session and there were also some good things said. I think we'll like what 3-time Syn-Aud-Con grad, Mary Gruszka, will do with her session.

Don and I will have Booth #58, as usual, and our suite on the 14th floor. It's the highlight of the year for us to see you there.

SBA UNITS NOW BEING SHIPPED

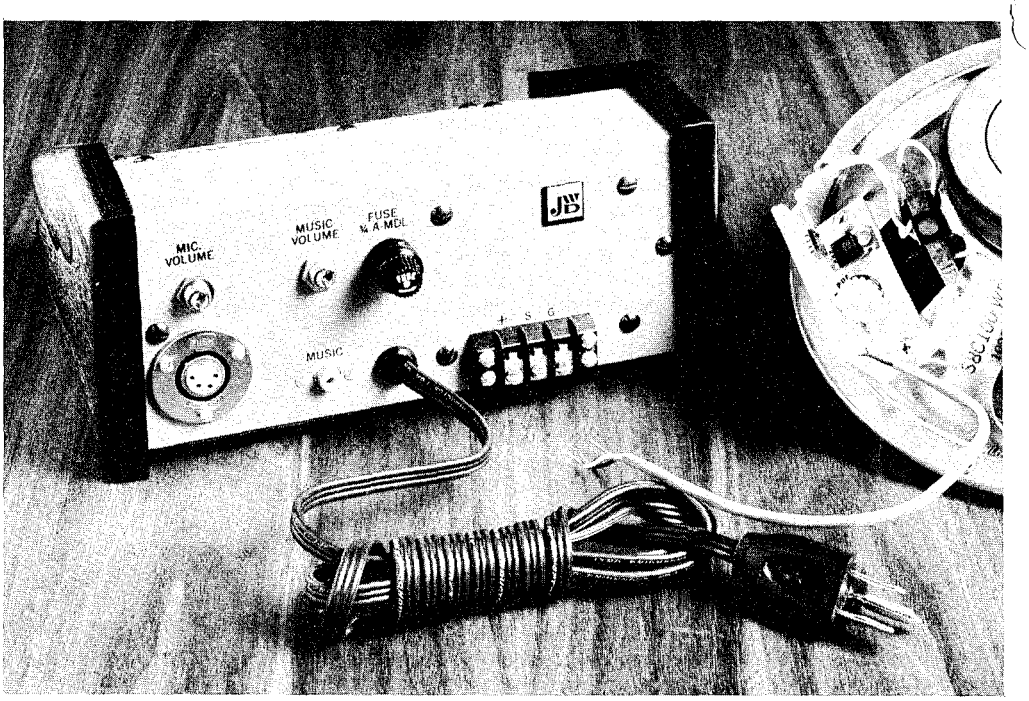
Signal Biased Amplification, SBA, sound systems are now being shipped to eager customers by J. W. Davis & Co.

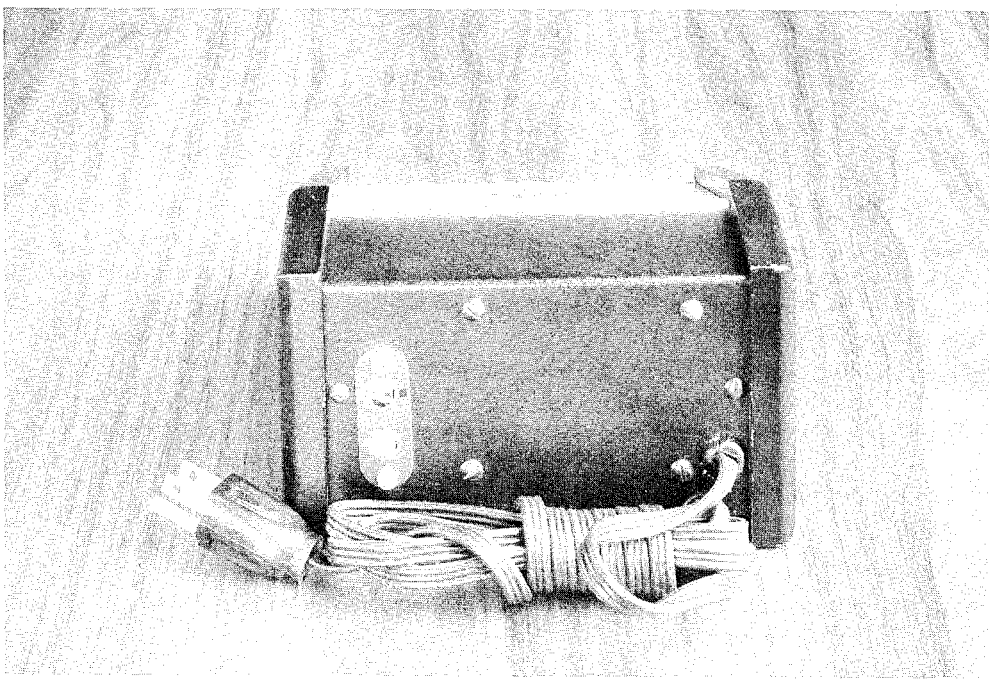
Long awaited pricing came as a most pleasant surprise in this inflationary world of today, but then, advanced technology has always been the way to beat such conditions.

Master Unit
(Includes power supply for up to 25-30 remote units)
Price. $89.95

Power Supply
(Power supplies are added along the line about every 25-30 units)
Price. $49.95

Remote Units
(One per speaker)
Price. . . . . $ 4.95





We'd suggest the purchase of a half dozen Remotes, along with a sampling of the J. W. Davis & Company 8" loudspeaker with ABS baffle.

Only costs $11.28 per unit.

Quality sound at a low price is no longer a contradiction.

New mailing address for:

J. W. Davis & Co.
P. O. Box 26177
3215 Canton Street
Dallas, Texas 75226

Ph: (214) 651-7341

Syn-Aud-Con is eager to publish as a Tech Topic the most creative of the early SBA installations.

RADIO TELEPHONE FOR SALE

Syn-Aud-Con has for sale a radio telephone: Canyon Communications Mark 900 in deluxe attache case. Fully equipped for either manual or automatic (IMT) service. Extra antenna (magnetic for vehicle). Regular antenna in lid of attache case. Battery charger and accessory cord. 25 watts on its own internal battery. 55 watts when connected to vehicle battery via lighter socket. Original price $3,100, asking $2,200. This unit is like new.

With the advent of telephone service to our home in the mountains, we no longer need a radiotelephone. This unit allows you to receive calls anywhere you carry the handy attache case - in your car, at restaurants, on boats, in elevators, etc. A real savings on a deluxe unit. Operates in the 150mHz region.

PROGRESS REPORT ON LEDE™ CONTROL ROOMS

Three fully qualified "Live End-Dead End™ (LEDE™) control rooms are now in existence plus one highly modified room capable of being classified as LEDE™. Many more are currently in process and will be reported on in future Newsletters. At this date, there is no longer any doubt regarding the acoustic superiority of this technique. Once it was recognized that the LEDE™ technique allowed control of the initial time delay gap (ITD) and that the "live end" of the room psychoacoustically cancelled, the operative mechanisms became easily understood and acknowledged by any competent observer.

As a result of the increased LEDE™ design activity, many new embellishments are being discovered and put into practice. Key among these developments is the utilization of an assymetrical concrete outer shell with a symetrical inner shell of LEDE™ materials.

To facilitate the needs of those seeking direct assistance with an LEDE™ project, we have set up a special consultation package through TEF™ (Time Energy Frequency) licensees who have attended Heyser classes. Utilization of this service results in a guaranteed LEDE™ control room.

There are many graduates working on their own versions of an LEDE™ control room (and we fully approve of and encourage such experimentation). Syn-Aud-Con has been pleased to offer this technique to the industry without recompense in order to help correct the acoustic chaos prevalent today. Syn-Aud-Con does, however, protect the integrity of our trademarked term, LEDE™, and its usage is restricted to only those control rooms which meet the criteria listed here.

LIVE END-DEAD END™ CONTROL ROOM CRITERIA

The term LEDE™ is applied to a control room when the following criteria have been satisfied:

1. There is a low frequency non symmetrical outer shell, free of pronounced resonances at low frequencies. This shell is large enough to allow development of bass frequencies.
2. There is a symmetrical inner shell. The crossover frequency between the outer bass shell and the inner geometric frequency shell is

$$f_x = \left(\frac{3(\text{velocity of sound})}{\text{Smallest room dimension}}\right)$$

3. There is an effectively anechoic path between the monitor loudspeakers and the mixer's ears that extends for at least 2 to 5 msec beyond the studio's initial time delay gap.
4. There is a highly diffused (at geometrical frequencies) sound field present during the initial onset of the so-called Haas Effect.
5. The monitor loudspeakers, microphony technique and *mixing console* do not "mask" the desired anechoic path from the monitors to the listener, including the period beyond the monitor to ears physical distance (the studio ITD +2 to 5 msec).
6. No early early sound (EES) is present. This is sound that arrives at the mixer's ears *ahead* of the direct sound travelling through the air. EES occurs when monitor loudspeakers are not *shock mounted* and therefore radiate through the structure and re-radiate in the air, usually from the ceiling, near the listener.
7. The hard surfaced rear wall, rear side walls, and real ceiling are so spaced temporally as to provide interwoven comb filter patterns that become a high density early sound field without measurable anomalies.

Upon our receipt of confirming TEF™ measurements, we authorize the use of our Live End-Dead End™ and LEDE™ trademarks in connection with the control room in question. There are no fees attached to this usage and the TEF™ measurements may be made by any of the licensed practitioners under the Heyser patents.

Because Live End-Dead End™ and LEDE™ are becoming highly sought after labels due to the success of these early endeavors, we hope that every Syn-Aud-Con graduate will help us preserve the integrity of these terms and report to us any misuse of them. At least one major manufacturer has already attempted to adulterate the basic definitions of these terms and we are undertaking an active defense of them through our legal advisers. Syn-Aud-Con would greatly appreciate your help in informing us of flagrant misusers of these terms, which will let us follow them up legally.

Elsewhere in this Newsletter are reports on individual LEDE™ control rooms just completed. It can only be called exciting to watch the development of a logical acoustic discipline for small non-reverberant rooms backed up by relevant objective acoustic measurements as new as the room design techniques being measured.

EIA RELEASES POLARITY STANDARD

The EIA has released a polarity standard (Electronic Design, Nov. 22, 1979) which, as the announcement indicates, freely exchanges the terms "polarity" and "phase." There are helpful measuring techniques described but for definitions, I'll stick to my IEEE dictionary. (See Newsletter Volume 6, No. 1, page 23.)

EIA RELEASES POLARITY STANDARD FOR MICROPHONES

The engineering department of the Electronic Industries Association has revised standard RS-221, which deals with polarity or phase of microphones for broadcasting, recording or sound reinforcement. The revision, RS-221-A, gives detailed information about connections and methods of testing which will result in correct phasing when multiple microphones are in use.

Developed by the EIA committee on electro-acoustic components, the revision changes the scheme for making polarity, three-terminal, microphone connectors. It also revises the procedures for verifying polarity or for determining polarity in existing dynamic microphones for future comparisons. Copies of the document are $3, from EIA at 2001'Eye'St. NW, Washington, DC 20006.

CHIPS DAVIS HAS DONE IT AGAIN

His latest LEDE™ control room for The Music Place in Birmingham, Alabama, is a spectacular acoustic success. Randy Richards, President of The Music Place, engaged Chips as his Consultant/Designer. He used his own construction crews to build a remarkable acoustic environment that is visually exciting, as well. Randy's family is in construction in addition to many other activities in the Birmingham area.

Syn-Aud-Con was engaged as the Testing Consultant to verify the acoustic integrity of the LEDE™ control room. In addition to testing an exceptional control room, we had the pleasure of finding an unusually talented and hospitable family totally involved in making this studio a success. Randy's brother, father, and mother are all actively involved in this enterprise.

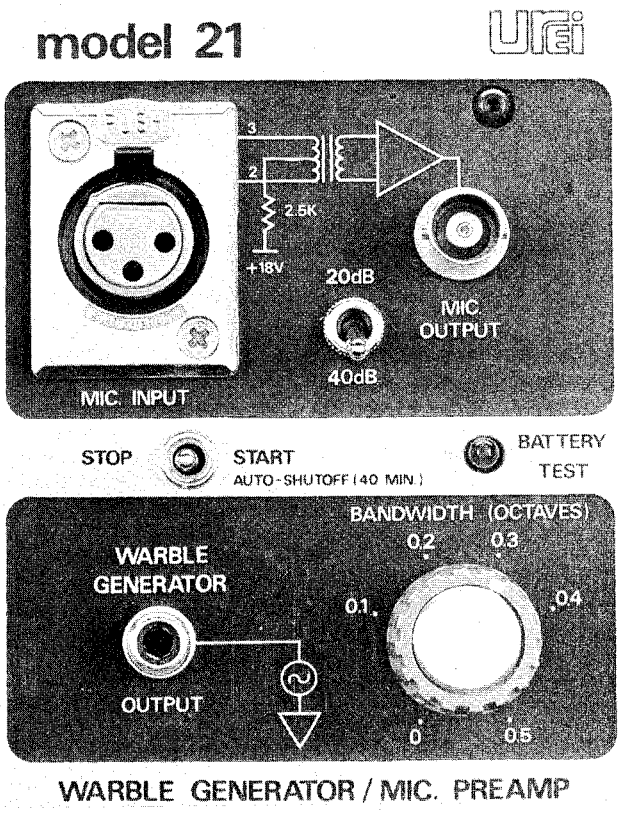
Chips' design incorporated a number of new LEDE™ innovations including a dual shell - one of concrete and one of conventional materials. The construction was impeccable and included, among other creative ideas, the use of an upholsterer to make the "dead end" visually harmonious. The "live end" contained some exceptional woodworking, and the ETC measurements confirmed that this was the best temporal patterning, to date, in a LEDE™ control room that we have measured.

The Music Place is willing to conduct demonstrations of this outstanding facility if contacted sufficiently in advance and scheduled into their very active use of the studio. We recommend, without reservation, that you hear this control room if you are interested in building a LEDE™ control room. The UREI 813s in this room are the best matched pair we have ever measured and the overall effect is that you can easily make a definitive judgement of LEDE™ technology without having to go clear to the West Coast.

UREI MIC PREAMP AND WARBLE GENERATOR

A most useful accessory for use with one of our most employed test instruments is the UREI Model 21 microphone Preamp and Warble Generator for use with their Model 200 level recorder equipped with their Model 2000 frequency response module. This is our preferred way to obtain the total sound level L_D in small, relatively dead rooms (control rooms). Battery operated, it switches off automatically after 40 minutes. (How many batteries I could have saved if my sound level meter had this feature.) The warble tone can be adjusted for bandwidths from sine wave through 1/2 octave with 1/10 octave and 1/3 octave marks especially useful. A calibrated microphone preamp answers a long felt need.

While the better commercial sound units, such as the Shure M-67, can be used, the small size and battery operation are so convenient as to make this unit the preferred choice every time. It is this equipment that we use in all low frequency measurements in checking out the new LEDE™ control room's certification.



WARBLE GENERATOR / MIC. PREAMP

THE GAIN OF AUDIO AMPLIFIERS by MEL SPRINKLE

Few basics in audio require a lengthy discussion. Normally, a careful statement of definitions and some examples suffice. As a Syn-Aud-Con subscriber to our Newsletters and Tech Topics, you have observed that four pages will cover almost any basic point in full detail. In the case of Mel Sprinkle's "The Gain of Audio Amplifiers," we are making an exception because of two facts:

1. It's a classic paper deserving inclusion in everyone's collection of fundamental data base material.
2. It covers in exhaustive detail a much misunderstood subject wherein many of today's practitioners take the position that they're not mistaken - the standard is mistaken. Be assured that the standard is solidly based on fundamentally correct premises and wait patiently for those who say otherwise to mature in audio.

Thus it is that we reprint this valuable paper for Syn-Aud-Con graduates. We're pleased and grateful to have Syn-Aud-Con graduate Mel Sprinkle's permission for this reprint.

TRANSFER OF COPYRIGHT AGREEMENT

The Syn-Aud-Con Newsletter offers you a marvelous opportunity. All it takes to become an author is the sharing of a good audio idea. Write and tell us about your latest way of installing components, a clever trouble-shooting job, or a unique sales approach that resulted in a sale. Once you've authored an article, you have an accomplishment under your belt that can never be taken away.

We are sending you the release form which you must sign to give us the right to print (the new copyright law requires us to have a release before printing). Send it along with your material. We really want to hear from you. We often hear that the Syn-Aud-Con publications are the most valuable audio publication received. They are because of *you*.

SHURE AND UREI SPONSOR SPECIAL SLIDE RULES

Shure recently supplied us with a new shipment of their SRC-1 slide rules (designed by Syn-Aud-Con) for use in our classes. Their generous support in the production of these calculators is much appreciated by all of us.

UREI, at the same time, again sponsored a new production of the large sound system calculator (also designed by Syn-Aud-Con) for use in our current classes. Without such generosity on the part of these special sponsors, it would be difficult to keep these excellent tools up-to-date.

Both slide rules have been widely accepted as the most accurate and easy to use in our industry. Both of these sponsors are dedicated to improved educational opportunities for those in audio, and this is one of the tangible ways they have chosen to express their interest and assistance.

UZZLE UTTERANCES

Yes! there really is a Ted Uzzle and those in doubt can view the real Ted Uzzle at the May 1980 AES West Coast Convention where Ted will serve as Chairman of the Motion Picture Sound session.

I have observed over the years that those who behave in the audio industry akin to the squirrel monkey's behavion discussed by Sagan were on unlimited expense accounts. Perhaps "That's what it means."

Ted's letter:

> On your recommendation I finally read Julian Jaynes' *The Origin of Consciousness in the Breakdown of the Bicameral Mind.* Just finished yesterday. Well, of course I want to read it again before hardening my opinion, but it reminds me of something a teaching assistant wrote on a term paper I wrote for an astronomy course: "One of us is a jerk; thank goodness I get to make the choice." Jaynes' description of smoking laurel leaves to determine if the Delphic oracle had psychedelic assistance seems typical of his entire sensibility. The footnote thereto, also.
>
> From there I turned to Carl Sagan's *The Dragons of Eden: Speculations on the Evolution of Human Intelligence,* a vastly superior book in every way, not least in common sense. Contrast Jaynes' chemical adventurism with this footnote from Sagan:
>
> > *Marijuana is often described as improving our appreciation of and abilities in music, dance, art, pattern and sign recognition and our sensitivity to nonverbal communciation. To the best of my knowledge, it is never reported as improving our ability to read and comprehend Ludwig Wittgenstein or Immanuel Kant; to calculate the stresses on bridges; or to compute Laplace transformations. Often the subject has difficulty even in writing down his thoughts coherently. I wonder if, rather than enhancing anything, the cannabinols (the active ingredients in marijuana) simply suppress the left hemisphere and permit the stars to come out. This may also be the objective of the meditative states of many Oriental religions. (p. 169n)*
>
> It's difficult to quarrel with such hardtack common sense. Sagan states it precisely and economically:
>
> > *The left hemisphere processes information sequentially; the right hemisphere simultaneously, accessing several inputs at once. The left hemisphere works in series; the right in parallel. The left hemisphere is something like a digital computer; the right like an anolog computer.*
>
> In the second Jacob Bronowski memorial lecture, Philip Morrison drew the distinction of two bridges between symbol and reality: perceptual and abstract. "Grass" and "glass" are abstract: although very similar in sound and spelling, the things represented have no similarity whatsoever. Arabic numerals, digital strings, algebraic formulations, zip codes, all are left hemisphere-invented. Egyptian heiroglyphics, Chinese pictograms, isometric renderings, commemorative stamps, all are right hemisphere-invented. Wherever invented, each hemisphere can use anything, though to perhaps different purposes.
>
> I haven't yet gotten around to Sagan's *Broca's Brain.* It seems to me that if Jaynes and Sagan met at a party they wouldn't spit at each other, they would only be mutually embarrassed, and each for good reason.
>
> It puts me to mind of a passage from Sagan:
>
> > *Squirrel monkeys with "gothic" facial markings have a kind of ritual or display which they perform when greeting one another. The males bare their teeth, rattle the bars of their cage, utter a high-pitched squeak, which is possibly terrifying to squirrel monkeys, and lift their legs to exhibit an erect penis. While such behavior would border on impoliteness at many contemporary human social gatherings, it is a fairly elaborate act and serves to maintain dominance hierarchies in squirrel monkey communities.*
>
> Yes, but what does it all *mean*?

HP 85 (CAPRICORN) COMPUTER

While we have yet to see it, the new HP "home" computer, the HP 85 code named the "Capricorn", made its appearance at the Winter Consumer Electronics show in Las Vegas January 5-8. Price mentioned is $3250. Features cited are "powerful central processor, typewriter-like keyboard, cathode ray tube (rumored to be a very small 5"), thermal printer, tape cartridge, and interactive graphics capability" all in a fully integrated system the size of a portable typewriter. Some three years in development, it is programmed with English-like basic language.

Manufacturing will be done at HP's Cornwallis, Oregon plant.

Some comments heard from "hard core" home computer addicts:

"Tape cartridge not as good as disc drive"
"Cathode ray tube too small"
"Total capacity and speed unknown"

While we all know that HP is capable of remarkable feats such as the HP 41C, when they specifically label something "Consumer," as they did their wristwatch, they sometimes don't measure up to their high professional standard. Therefore, our interest in the HP 85 is quite high, but our money will remain in our pocket until we have had a chance to see and evaluate it for ourselves.

RAULAND'S NATIONAL SALES MEETING

In late November we flew to Fort Lauderdale, Florida, to be the guest of the Rauland Corporation at their huge national sales conference.

A significant "sign of the times" was the exceptionally well designed and installed sound system used at this meeting in the main ballroom (covering over 500 people at a time). It was highly intelligible, free of extraneous sounds, and provided extremely uniform coverage. Rauland's use of Emilar drivers, their new digital time delay devices, and their already well-known high-powered electronics resulted in a system so impressive Carolyn has asked them to do it again for the West Coast AES Convention in May, 1980. (Carolyn is the Convention Chairman for this convention.)

I addressed the gathering on the dangers to the commercial and professional sound market places from the less ethical Japanese firms. It is Syn-Aud-Con's belief that those foreign firms attempting economic disruption of major market places by selling below their costs, extending unrealistic credit terms, and buying pseudo consultants' endorsements should be shunned by the sensible sound contractor.

This is not to imply or suggest Syn-Aud-Con is anti-Japanese or anti-foreign firms. Syn-Aud-Con is opposed to the use of ruthless foreign marketing techniques when used here in the United States. We're sure you all know the feet these shoes fit.

A proper use of foreign products in the American market place is the example set by the marketing of the Phillips intercom line through Rauland commercial sound contractors plus selected special outlets. Syn-Aud-Con is hopeful that our industry will see increased creative combinations of this type where the strengths of each organization are given an opportunity to blossom.

Rauland announced their acquisition of Picker-Briggs which provides them instant access into the massive health-care market place.

We came away from this meeting with the very strong impression that Rauland is the dominant manufacturer in the commercial sound industry in the 1980's. They've done their homework, paid their dues by creating unbelievably competent sales and engineering forces, and their leadership is doing just that--*leading*.

It's refreshing to see an American sound manufacturer with abundant capital, excellent staff, aggressive (but not arrogant) goals, and the patience and wisdom to adjust them to the rapid competitive changes that can and will occur in this new decade.

NOISE CRITERIA TABLE

We have used the following criteria tables for several years now. They appeared, so far as we know, originally in an article, *Mechanical System Noise Control in Buildings* by Howard F. Kingsbury, published in the Tutorial Papers on Noise Control, InterNoise 72 (held in Washington DC). Of particular usefulness is the "A" weighted ratings in addition to the NC values, thus enabling those with a budget sound level meter to write in at least a partial safety clause against excessive noise levels.

Type of Area	Range of A-Sound Levels, Decibels	Range of NC Criteria Curves
RESIDENCES		
Private homes (rural and suburban)	25-35	20-30
Private homes (urban)	30-40	25-35
Apartment houses, 2-and 3-family units	35-45	30-40
HOTELS		
Individual rooms or suites	35-45	30-40
Ball rooms, Banquet rooms	35-45	30-40
Halls and corridors, Lobbies	40-50	35-45
Garages	45-55	40-50
Kitchens and laundries	45-55	40-50
HOSPITALS AND CLINICS		
Private rooms	30-40	25-35
Operating rooms, Wards	35-45	30-40
Laboratories, Halls and corridors	40-50	35-45
Lobbies and waiting rooms		
Washrooms and toilets	45-55	40-50
OFFICES		
Board room	25-35	20-30
Conference rooms	30-40	25-35
Executive office	35-45	30-40
Supervisor office, Reception room	35-40	30-45
General open offices, Drafting rooms	40-55	35-50
Halls and corridors	40-55	35-55
Tabulation and computation	45-65	40-60
AUDITORIUMS AND MUSIC HALLS		
Concert and opera halls	25-35	20-25
Studios for sound reproduction		
Legitimate theaters, Multi-purpose halls	30-40	25-30
Movie theaters, TV audience studios	35-45	30-35
Semi-outdoor amphitheaters		
Lecture halls, planetarium		
Lobbies	40-50	35-45
CHURCHES AND SCHOOLS		
Sanctuaries	25-35	20-30
CHURCHES AND SCHOOLS (Cont'd)		
Libraries	35-45	30-40
Schools and classrooms	35-45	30-40
Laboratories	40-50	35-45
Recreation halls	40-55	35-50
Corridors and halls	40-55	35-50
Kitchens	45-55	40-50
PUBLIC BUILDINGS		
Public libraries, Museums, Court rooms	35-45	30-40
Post offices, General banking areas, Lobbies	40-50	35-45
Washrooms and toilets	45-55	40-50
RESTAURANTS, CAFETERIAS, LOUNGES		
Restaurants	40-50	35-45
Cocktail Lounges	40-55	35-40
Night clubs	40-50	35-45
Cafeterias	45-55	40-50
STORES RETAIL		
Clothing stores	40-50	35-45
Department stores (upper floors)		
Department stores (main floor)	45-55	40-50
Small retail stores		
Supermarkets	45-55	40-50
SPORTS ACTIVITIES INDOOR		
Coliseums	35-45	30-40
Bowling alleys, gymnasiums	40-50	35-45
Swimming pools	45-60	40-55
TRANSPORTATION (RAIL, BUS, PLANE)		
Ticket sales offices	35-45	30-40
Lounges and Waiting rooms	40-55	35-50

Table 1. Ranges of Indoor Design Goals for Air-Conditioning System Sound Control

EMILAR MOVES TO NEW LARGER PLANT

The acceptance of Emilar precision compression high frequency drivers has led to another move to a still larger, more modern facility.

Their new address is

1365 McCann St.
Anaheim, CA 92806
Ph (714) 632-8500

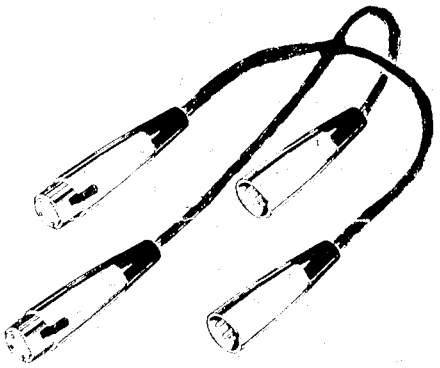
This new building provides space for increased production and research.

Emilar's extensive machine tool capability is laid out for maximum efficiency and large laboratory space is now in use.

Syn-Aud-Con graduates can be justifiably proud of their part in helping this dynamic company enjoy such rapid recognition and growth.

HANDY ACCESSORY

Walter Schmidt, Jr., owner of Walt's TV Sales and Service in Taft, California, has found the cable arrangement shown here so useful he quotes the American Express slogan--"Never leave home without it."



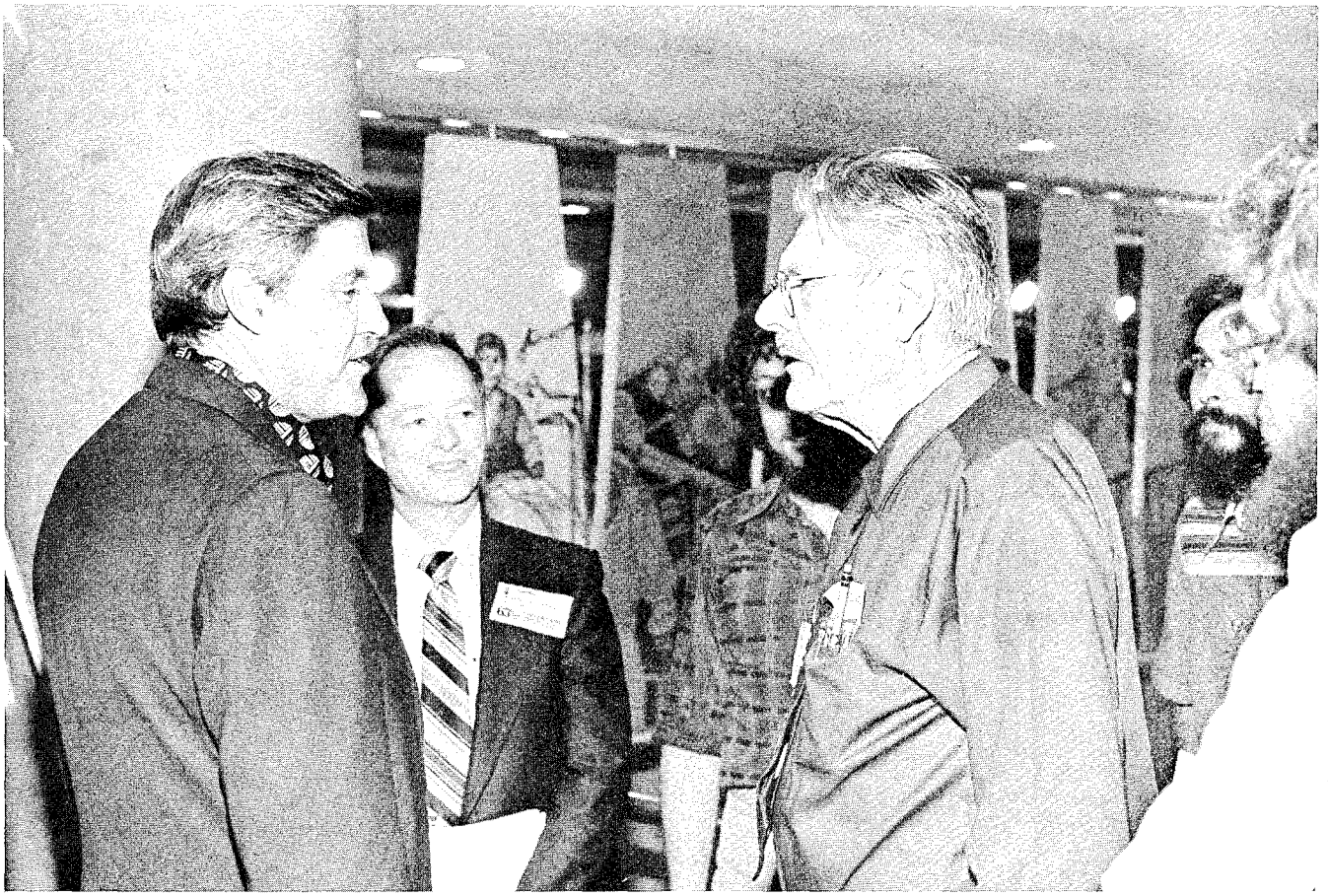
"Thought I would send you a sketch of my 'Octopus Adapter.' I find it has many uses and saves time when you end up with a mike and amp with the same plug or you want to parallel two mikes, etc. I just made a splice with four short pieces of mike cable with the two types of plugs. It's like American Express says--'Never leave home without it'."

SYN-AUD-CON PUBLISHES NEW BROCHURE

In keeping with our new format of classes in Southern California we have a new brochure giving the details. It answers questions like, Where is Dana Point? What will I learn in the class? What are the charges?

Most of the illustrations used are from our Fall 1979 classes held at the Marina Inn in Dana Point. If you would like extras for a friend, drop us the name and address and we'll be pleased to mail one to them. Your copy is included in this set of Newsletters and Tech Topics.

PAUL W. KLIPSCH



picture taken by Fritz Held

One man that can hold the attention of Dick Heyser, Don Davis, and in fact the attention of the entire AES is Paul W. Klipsch.

One experience Syn-Aud-Con founders look forward to every year is the chance to visit with Mr. Klipsch. The understatement of the last three decades is to say that Mr. Klipsch has had a lasting (beneficial) influence on us. The AES is immeasurably richer for his presence and the audio industry is beholden to him for his touch of honest sanity in the midst of posturing seekers after fame and fortune.

We keep hoping this picture will serve as a "guilt by association" document.

ULTIMATE LOUDSPEAKER CABLE??

Don Eger of Crown International is holding a cable that is shielded against electromagnetic, electrostatic, cosmic, x-ray, nuclear, etc., radiation. Wait till the HiFi fans hear about this.

The piece of cable was pulled out of a conduit at Radio City Music Hall in New York by Bobby Estrin and crew from Filmways Audio when they installed a new sound system there. It has a lead jacket around copper braid, and solid copper microphone cables. They didn't fool around with transmission fifty years ago.

This happy group was in the process of contemplating the ad they would compose for this cable as "speaker wire".

Larry Estrin, president of Filmways Group, gave us this sample of the truck loads of copper cable that was hauled away during the sound system redo. Larry arranged a tour of the Hall for Syn-Aud-Con graduates attending the New York AES last Fall.

This was the most deadly, but legal,"sap" we've seen - and in New York City that's a consideration, too. "Who, me, officer? I'm an audio man."

REPORT ON THE HP 41C CALCULATOR SYSTEM

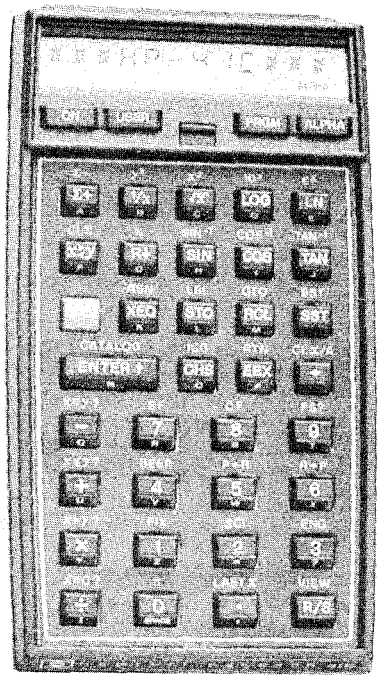
The HP 41C is the first calculator designed to be part of a system. It has universal parts for ROM, RAM, and other accessories.

A comparison of the HP 41C with the TI-59 quickly tells why so many Syn-Aud-Con graduates who bought the TI-59 are shaking their heads and saying "Oh well, I guess I need them both."

Manufacturer	TI-59	HP 41C
Logic	Algebraic	Reverse Polish Notation
Introduction	July, 1977	July, 1979
Max. prog. steps	960	2223
Max. data registers	100	319
External mass memory	Magnetic cards	Magnetic cards
Plug in ROM	5000 steps	4000 steps
Display type	LED	LCD
Display range	± 10/2	± 8/2
Alphanumeric display	NO	YES
Size	6-1/2 x 3-1/4 x 1-3/4"	5-5/8 x 3-1/8 x 1-1/4"
Weight	12.5 oz.	7.25 oz.
Memory retention	NO	YES
Battery system	Secondary	Primary
Batteries	3A size NICADS	4 Type N
Battery operating time	3 hours	9 to 12 months
Major accessories	PC ÷ 100C Thermoprinter-plotter, ROM	Plug-in Thermoprinter-plotter, card reader, bar code wand, ROM, RAM

Syn-Aud-Con currently has three of these HP 41Cs and the primary one has three memory modules, the plug-in card reader, the plug-in thermoprinter-plotter, and a spare power supply and battery pack for the printer. The bar code wand is on order.

Our HP 41C completely exceeds every usage we ever put our $7600 HP 9820 computer to when we started Syn-Aud-Con over seven years ago. The HP 41C has a vastly superior printer-plotter, more versatile input-output capabilities, and memory retention (an unbelievable luxury). We personally find battery power exceptionally useful as we live seven miles from public power, and it's most convenient not to have to switch on the Onan generator just to do a calculation.



HP has now met the wildest forecast I was able to make back in 1976. I'm hard put to even guess what the next generation of handheld calculator/computer is likely to be. Let's ask for:

1. 100,000 steps of memory.
2. A peripheral display (battery powered) with full graphics capability as well as math and text display.
3. A full page printer-plotter (battery powered).
4. May be programmed from its own keyboard or from a deluxe full size keyboard when at home.
5. Built in software for business calculations, mathematical calculations, word processing, and mailing list work.
6. Price not to exceed $1500 in 1980 dollars.

Wild you say? I asked for the precise specs the HP 41C now has in 1976. Let's be generous and give them five years this time.

HP has done zero national advertising of this unit - no mailings to their customer list - and the outlets selling them are backordered over six months. Maybe we should be buying HP stock.

We have reproduced HP41 programs from Ray Rayburn in New York and Bill Raventos of Ivie as well as a couple of our own programs. Send $3 and we will send you what programs we have.

ERRATA

Glen Ballou says that it is our duty to publish an errata each issue, making the corrections on technical mistakes in the previous one. We have to concede that he is right.

In the Newsletter, Volume 7, Number 1, page 29, the formula in mid-page is written:

$$\%Al_{cons} = \frac{656(20)^2}{500{,}000(2.5)} = .32\%$$

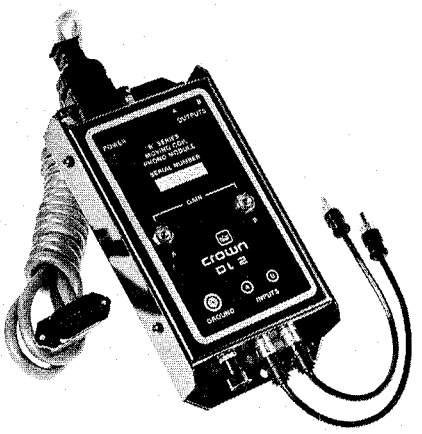
It should have been written:

$$\%Al_{cons} = \frac{656(20)^2(2.5)^2}{500{,}000(2.5)} = .32\%$$

CROWN'S NEW MOVING COIL PHONO MODULE

Various Syn-Aud-Con graduates have expertise in many areas. Nelson Meacham, Electronics Engineer at Walt E. Disney (WED) in Burbank, has a devoted interest in sound reproduction in the home. He comes to visit us and brings along his *entire* music system. The usual result is that we are poorer in the pocketbook but higher in musical fidelity.

He recently demonstrated to us that our old Marantz preamp was obsolete (it was hand-picked for us by Saul Marantz just before he left the Marantz Company). We asked our sponsor, Crown, to loan us an up-to-date unit to try. One of their Straight Line units arrived along with their Moving Coil Phono Module, DL-2. The contrast was absolutely startling! Needless to say, the electronics in our music system is now all Crown.



If you have not encountered these new modularized preamp systems, let me encourage you to do so.

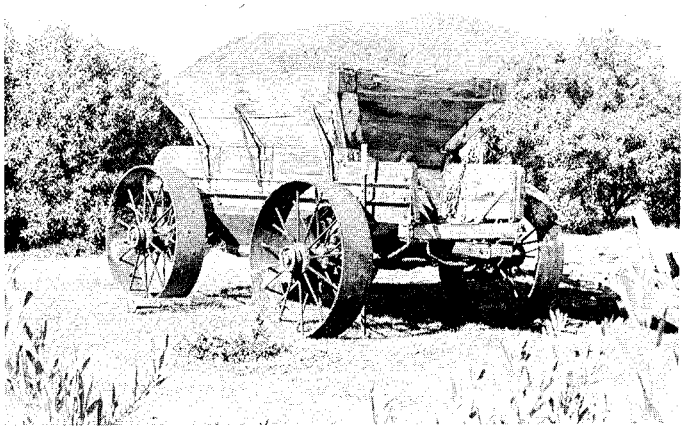
Incidentally, our Shure cartridge, V15, Type IV, works just great through the Moving Coil Module (just turn the gain clear down). I'm investigating how Crown has been so successful in designing an apparently universal input.

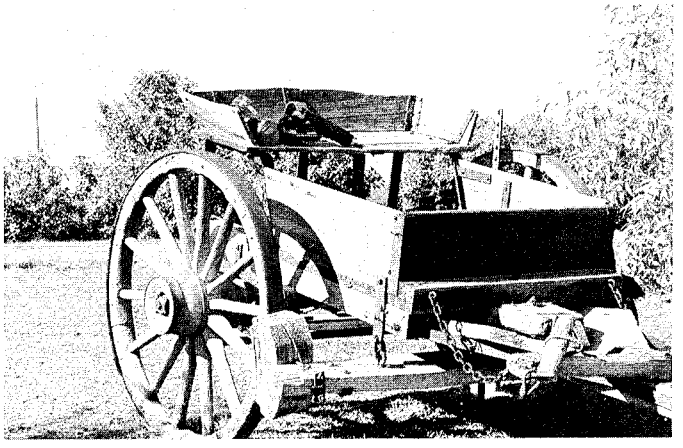
WESTERN WAGON WHEELS

I am an unabashed history buff and never more so than when it is western lore. Whether it be Remington, Schreyvogel, Russell, or Farney paintings and bronzes or books and articles from Jedediah Smith to Frank Hamer, I am resistless to their spell.

Riding a powerful horse, shooting the heavy revolvers and rifles of that era, and exploring the back country of the Far West can bring alive many passages in books that would otherwise be casually accepted or overlooked. Being an incurable romantic helps, as well.

With this brief explanation as a background, you can imagine the thrill given Carolyn and myself when close friends, descendants of pioneer families in northern Nevada who built the first roads in their area, asked us up to the family ranch to take our choice of old wagons stored in their "bone yard." The "bone yard" consisted of about 3 acres of Western artifacts, circa the 1890's to the early 1900's. Wheels, wagons, harnesses, saddles, and tools of every sort had been stored away over the years rather than being disposed of. We brought home an authentic ore wagon (its twin is at Bode, California--the old turn-of-the-century mining town--now a national monument). The large metal wheels have hand-forged seams where the weld was made to complete the wheel. This wagon is a treasure trove of the technology of the 1890's and is in full working order including its dump gates in the bottom operated by chains around threaded drums.





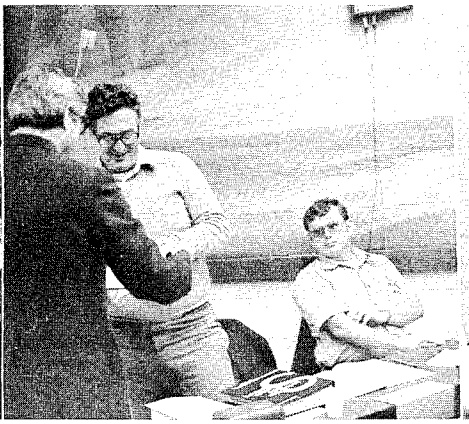
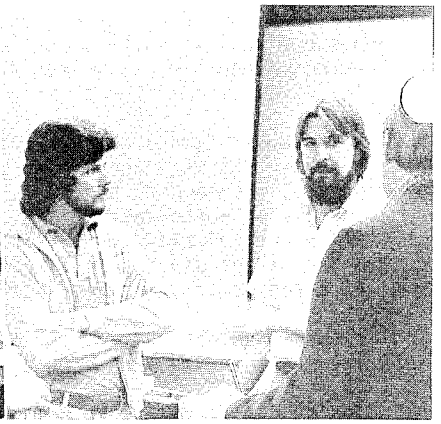
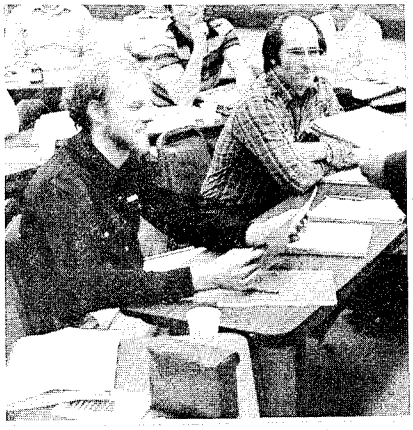
A second wagon is a horse training cart. It was built in the late 1920's from parts out of the "bone yard" and the young cowboy who first rode it is now a very senior cowboy who took a last ride in it as it was towed to a loading ramp to be put in our truck. This cart would have one tame horse and one wild horse fastened to it and then the rider, using massive mechanical brakes, would be dragged about until the wild horse learned to follow the tame horse. The old saying "take a deep seat" was no where more applicable than here.

These irreplaceable wagons now reside in our front yard within easy rifle shot of our deputy sheriff neighbor.

RENEWAL NOTICE

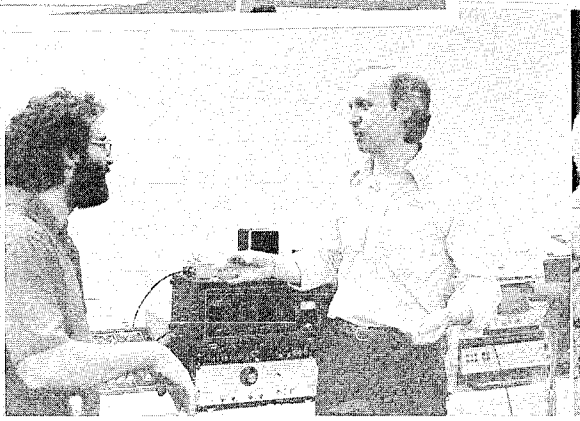
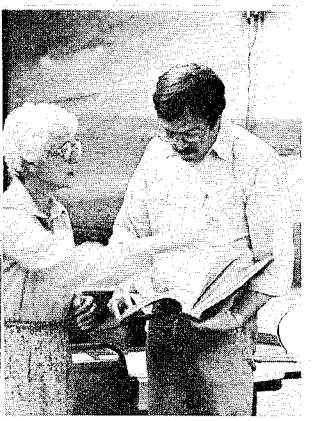
Someone asked us why we didn't include the renewal notice for the Newsletter subscription with the last issue. It seemed like a good idea. Therefore, if your subscription is due for renewal, starting with this mailing, a renewal form is included.

NOVEMBER CLASS AT DANA POINT, CA

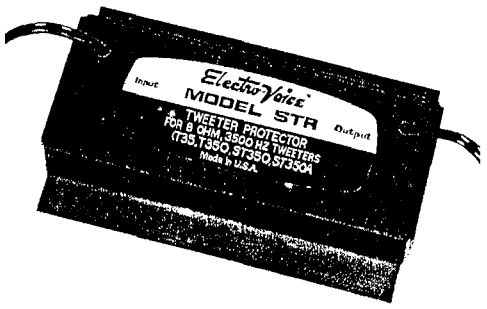




ELECTRO-VOICE TWEETER PROTECTOR

Bob Behm of Southwest Sound and Electronics, Inc., of Austin, Texas, brought to our attention the Model STR Tweeter Protector made by Electro-Voice of Buchanan, Michigan. As Bob points out to us in his letter, this device has been used on a number of jobs in his area and could appear in specifications in your area as well.



DESCRIPTION

The Model STR tweeter protector is a device which protects tweeters from potentially damaging input levels. The Electro-Voice STR was specifically designed for use with the Sentry™ IV and other systems using the ST350A tweeter. It can also be used with systems using tweeters such as the Model T35 and T350.

The STR is a relatively simple, electro-mechanical voltage-sensing device which opens the tweeter circuit when potentially damaging input level is reached. When input level is safe, the tweeter circuit is again closed. Opening and closing of the circuit is accomplished by a sensitive, but ruggedly built, relay with an approximate 1 millisecond throw time. Release time is approximately 3 milliseconds.

The STR is ideal in situations where accidental high input level surges may occur or where the speakers are in a difficult location to get to, such as above a proscenium arch. In recording studios where high levels are dealt with, and occasionally tapes are fast-wound or fast-rewound with tape lifters partially down, the STR provides adequate tweeter protection. In systems for high level sound reinforcement, particularly with rock and other types of music with inordinate amounts of high frequency energy, the tweeter protector helps to ensure long-lasting, reliable operation.

APPLICATION NOTES

Most sensing devices which are strictly electrical allow only a certain voltage level to pass before the tweeter is disconnected, regardless of time duration. Since most speakers are able to withstand higher power over very short periods of time (as in wave front peaks and short surges), such a device tends to limit the dynamic range of the tweeter.

The STR employs a special electro-mechanical design which enables wider dynamic range. High power level signals of short time duration which will not damage the tweeter are passed through the device. This allows for uninterrupted wide dynamic range program material and actually increases *effective* power-handling of the whole system. Signals with high *average* power levels (potentially damaging) are stopped from reaching the tweeter.

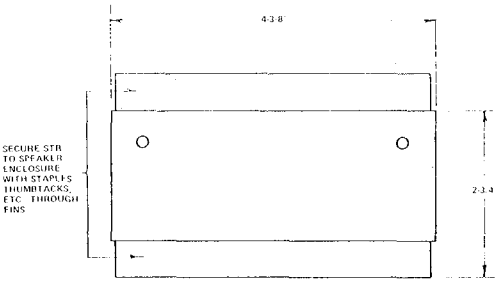


FIGURE 1 – Dimensions

APPLICATION NOTES

When the tweeter protector is in use, the speaker will operate normally until potentially damaging input levels to the tweeter are reached. As the relay opens the circuit, a slightly audible click will be heard. This is a warning that the power level to the tweeter is too high. Either the input power should be reduced, or high frequencies should be attenuated one additional position at the crossover. In situations where the tweeter is operating near the threshold of its power handling capability, the tweeter protector may oscillate, switching the tweeter rapidly in and out of the circuit. Again, the power level should be reduced either by lowering the input power level, or by attenuating the high frequencies at the crossover.

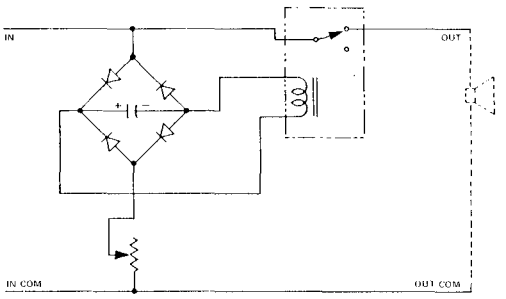


FIGURE 2 – Wiring Diagram

CONNECTING THE STR

The STR is an in-line device which should be inserted between the tweeter and the crossover. The wires marked "output" should be connected to the terminals on the tweeter, the striped lead corresponding to the (+) or positive terminal on the tweeter. The wires marked "input" go to the crossover. (See Figure 3.)

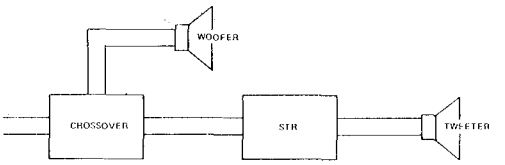
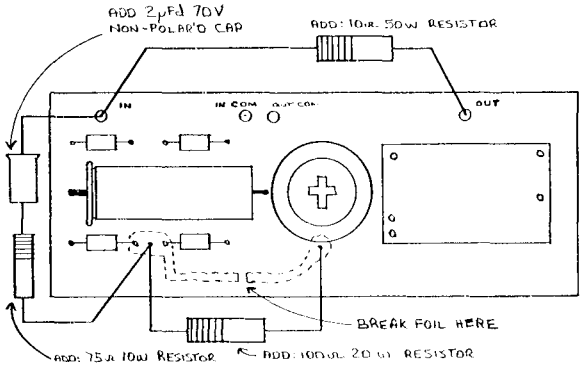


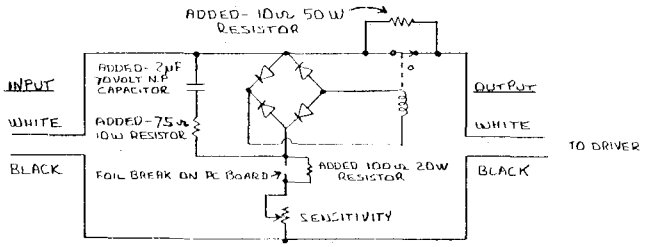
FIGURE 3 – Application Block Diagram

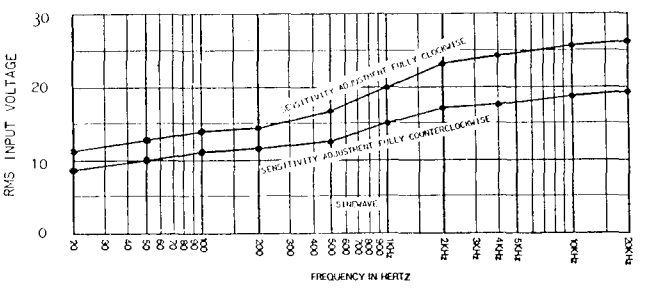
STR MODIFICATION FOR HIGH FREQUENCY DRIVER PROTECTION

THE ADDITION OF THREE RESISTORS AND A CAPACITOR TO THE STOCK STR IS ALL THAT IS NEEDED TO PROVIDE PROTECTION FOR THE DH1012, 1323, 1823M, AND 1829 DRIVERS. THE MODIFIED STR INTRODUCES APPROXIMATELY 6 DB LEVEL LOSS IN THE CUTOUT MODE (ASSUMING AN 8-OHM DRIVER). AS OPTIONS, A #307 28 VOLT AIRCRAFT BULB MAY BE USED IN PLACE OF THE 10-OHM RESISTOR OR THE RESISTOR MAY BE LEFT OFF COMPLETELY IF FULL DRIVER CUTOFF IS DESIRED.

ADJUSTMENT IS MADE BY FIRST DETERMINING THE VOLTAGE THE DRIVER SHOULD CUT OUT AND THEN, WITH THE USE OF A VOLTAGE SOURCE AND RMS VOLTMETER, ADJUSTING THE SENSITIVITY CONTROL ACCORDINGLY.

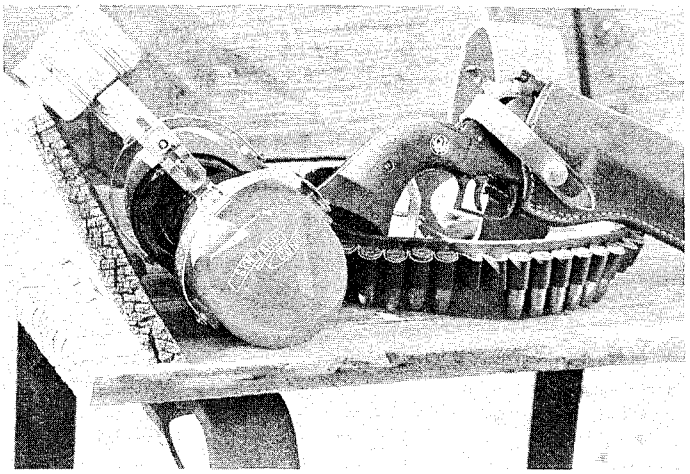


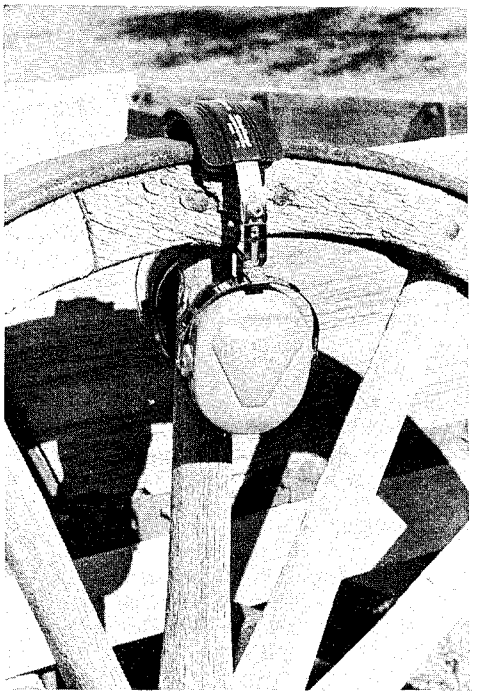




CUTOUT VOLTAGE VS. FREQUENCY

SYN-AUD-CON HEARING PROTECTORS FOR SALE





Quoting from an article in the "American Rifleman" of September, 1975, entitled "Gunfire Noise Levels" by William Dresser -- "Well-qualified otologists seem to be in general agreement that approximately 150 dB should be the maximum peak sound pressure limit for gunfire noises without considerable danger of impairment of speech reception. About 140 dB seems maximum for such noises without danger of loss of good hearing of music, etc., and 160 dB about maximum to avoid requirement for payment of compensation for industrial hearing loss."

Some examples are quoted:

1. A 12 gauge, gas operated, 28" barrel shotgun with Cutts compensator:

   172.5 dB PSPL
   Duration: 2.8 milliseconds

2. A 22 caliber short, hollow point, high speed (barrel length unspecified but fired in a rifle):

   157.0 dB PSPL
   Duration: 2.4 milliseconds

3. A .458 Magnum caliber rifle:

   174.7 dB PSPL
   Duration: 2.5 milliseconds

For those Syn-Aud-Con graduates desiring to make such measurements, you require a 1/4" or 1/8" high intensity microphone. Your standard measurement microphones and the time constants in your standard analyzers and sound level meters can't do the job. Recording high speed oscilloscopes are recommended.

The hearing protector offered by Syn-Aud-Con is specially manufactured for us by our sponsor, David Clark Company. It is a Model 27-L with a special Syn-Aud-Con imprint on each earpiece. (See illustration)

These protectors are without question the finest we have ever tested, are much lighter in weight and smaller in bulk than our previous personnel protectors and at least 6 dB more effective. Absolutely no disturbance of hearing occurs even when shooting the .458 Magnum. Consequently, we feel confident in recommending these protectors without reservation for audio men desirous of preserving their wide frequency range sensorium.

Our price is $18.40 plus $1.00 for postage.

SYNERGETIC

SYN AUD CON

AUDIO CONCEPTS

GLEN BALLOU ANSWERS TERRY HOFFMAN

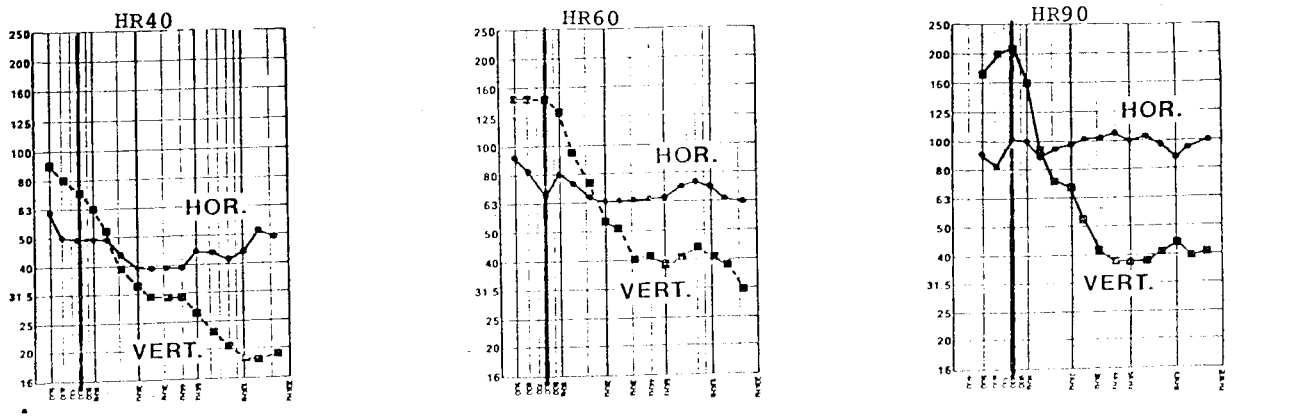
Here is Glen Ballou's answer to Mr. Hoffman's letter in Volume 7, No. 1, Newsletter. What fascinates us is the wide sweep of experience each graduate has access to and how, by writing for the Newsletter, all of us get to share it with them.

Dear Mr. Hoffman:

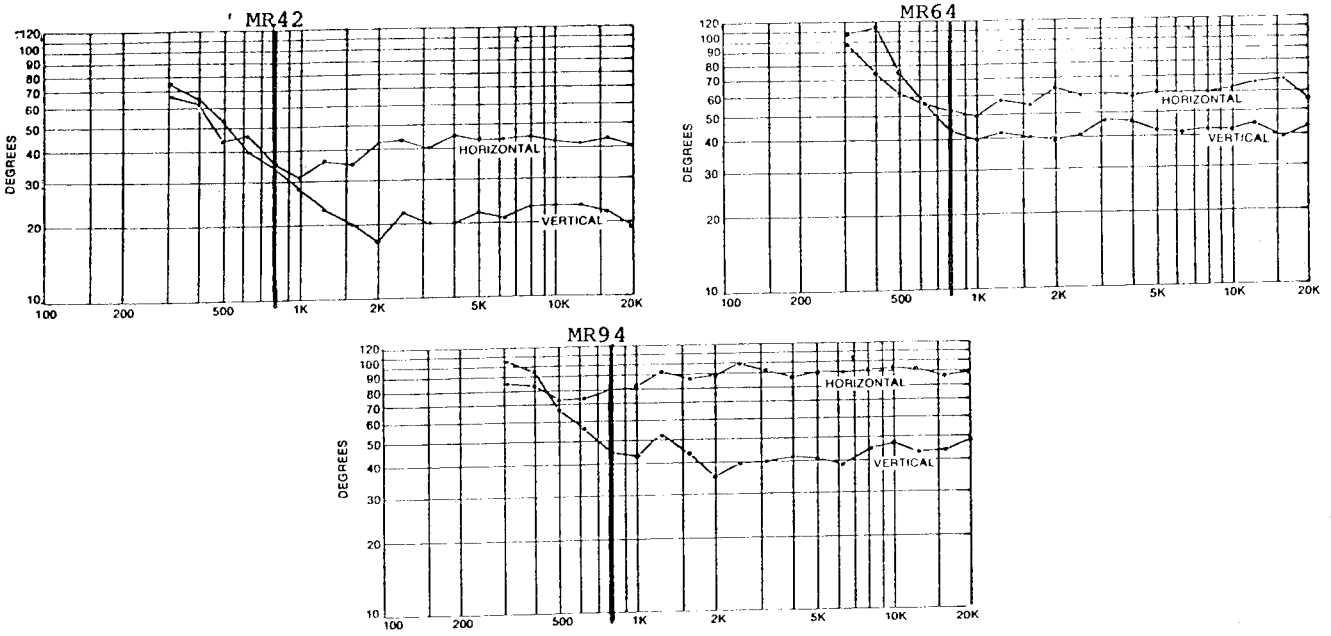
I would like to reply to your letter to the editor in the Syn-Aud-Con Newsletter with reference to constant directivity horns. I am certainly in partial agreement with you about the Electro-Voice HR series "White" horns. They are a beginning of a true constant directivity horn. However, if you look at the attached sheet, BEAMWIDTH IN DEGREES, you will note that while the horizontal beamwidth remains relatively constant, the vertical beamwidth varies 3-5 times design criteria. In fact, the dispersion angles are not much different than any other sectoral horn. You also note that in the attached dispersion of the Mantaray horns, the beamwidth remains constant both horizontally and vertically.

BEAMWIDTH IN DEGREES
(-6dB)

ELECTROVOICE



ALTEC

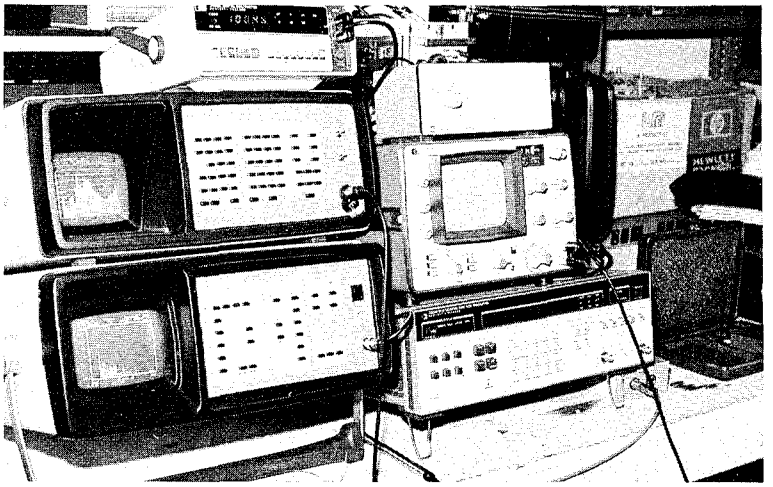


One evening in a gab fest at AES, Don Keele, then of Klipsch and designer of the famous EV "Whites," said to Cliff Hendrickson of Altec, "I wish I had thought of that and I could have made the EV horns constant directivity in both directions." While I agree that many architects consider the two horns equal, testing shows that they are not equal and probably should not be considered interchangeable. I am certainly not shooting down the EV horns, however, I am not prepared to call them true constant directivity horns.

Letters to the Editor are very important and people should write more of them when they feel it necessary, as this does create more synergy and better ideas.

Sincerely, signed Glen Ballou

NEW TEF™ LICENSEES



TEF™ licensing continues to expand. We now have licensees in Australia, Argentina, Italy, Singapore, and other interesting locations. We continue to view TEF™ measurements as a most exciting fundamental improvement in acoustic measurement. Those of you interested in a TEF™ class with Heyser instructing should let us know so we can place your name on our list for the next class. There will not be another special TEF™ class *until* we have received sufficient inquiries. Then a date will be set after we know who wishes to attend.

In the meantime, we continue to demonstrate in some detail what TEF™ measurements can do in our regular classes. If you haven't witnessed these demonstrations, you would be surprised how many aural effects are due to temporal patterning rather than frequency or amplitude variations. There is no question that this decade belongs to TEF™ measurements and that Dick Heyser will come into his rightful recognition as a fundamental discoverer of an important practical audio measurement system; far better than those in current use.

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Nashville, TN 37214

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Canoga Park, CA 91307

Dr. Eugene Patronis
1774 Northridge Road
Dunwoody, GA 30338

Mr. Kenneth Wahrenbrock
Wahrenbrock Sound
9609 Cheddar Street
Downey, CA 90242

Mr. J. G. Mitchell
1120 Stonehedge Drive
Schaumburg, IL 60194

Mr. Dan J. Zellman
Howard M. Schwartz Recording
420 Lexington Avenue
Suite 1934
New York, New York 10017

Mr. Richard Lee
Compass Point Studios Ltd.
P. O. Box N 4599
Nassau, Bahamas

Mr. Bernie Cahill
Rauland Borg Corporation
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Mr. Gerald Stanley
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Mr. Mark Miceli
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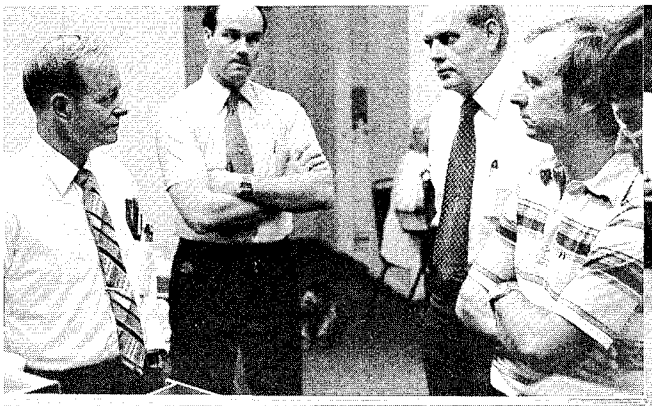

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SYNERGETIC AUDIO CONCEPTS

THE PERFECT POLAR PLOT

If it were possible to obtain, what would constitute the perfect polar plot? We can list the parameters we currently try for a start:

1. Every seat has the same $\%Al_{cons}$
2. Every seat has the same sound level

These two requirements would calibrate from the D_2 distance. Since the farthest D_2 is often in a back corner of a rectangularly shaped room, then the highest Q would be at the farthest D_2 and would be determined by the $\%Al_{cons}$ equations of Peutz.

How might such an unusual polar response be approximated? One way would be to imagine a multitude of transducers each just wide enough to cover only its listener and no other. Then the Q required by the $\%Al_{cons}$ might not fit the coverage required for the listener. This divides the search into two parts.

1. The desire to equally divide the available power among the listeners
2. The desire to provide each listener an identical quality signal from the source. (Identical quality being, for this purpose, the same $\%Al_{cons}$ and sound level.)

This division tends to come together again when it is realized that not only must the acoustic power be equally divided among the listeners but it must be done in such a fashion as to avoid having the total power radiated over-excite the reverberant sound field while providing sufficient level at the listener's ears.

Instead of controlling the Q of a transducer, it might be well to adjust D_2 and use fixed Q devices that exhibit special polar patterns.

USING THE HP41C TO SOLVE $ae^{i\theta}$

Exponential notation is a convenient way to designate a specific amplitude and phase for any specific frequency in a frequency response plot. For instance, if

$$ae^{i\theta} = 7.81e^{i.69}$$

What are the real and the imaginary components?

Equations of the type:

$ae^{i\theta}$ are solved by using $a(\cos\theta + i \sin\theta)$

where θ is in radians

We need the real and imaginary (so called) components first:

$a(\cos\theta)$ = the real part

$a(\sin\theta)$ = the imaginary part

where: a is the amplitude
θ is the phase angle in radians

First let's change the calculator to the radian mode

XEQ
ALPHA
RAD
ALPHA

Note that the RAD communicator turns on.

7.18
↑
.69
cos
x = 5.54 for the real component

7.18
↑
.69
sin
x = 4.57 for the imaginary component

Now, return the calculator to degrees.

XEQ
ALPHA
DEG
ALPHA

and then enter:

4.57
↑
5.54
SK
R-P = 7.18 $x\overset{>}{<}y$ = 39.52°

Thus, the amplitude is 7.18 and the phase angle is 39.52°.

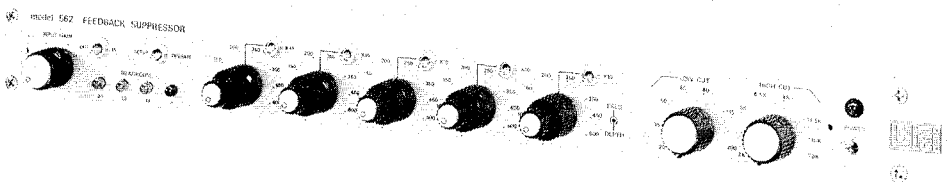
To double check:

XEQ
ALPHA
D
SK
-
R
ALPHA = 0.69 radians

REPORT ON UREI

UREI was Syn-Aud-Con's earliest sponsor. They are the current sponsor of the Syn-Aud-Con sound system calculator. Syn-Aud-Con has watched UREI's growth in the industry with a great deal of pleasure as their management consists of dedicated engineers devoted to our industry.

Several of UREI's new products have proven particularly useful to our class demonstrations. Their new Model 562 feedback suppressor is of particular interest. This unit contains five 1/6 octave notch filters that are tuneable from 60 to 6000 HZ. In our opinion, this is the *correct way* to employ 1/6 octave filters. Previous attempts by other manufacturers have, in our opinion, missed the underlying principle behind the cause requiring filters narrower than 1/3 octave.



Briefly, the effects causing narrow band frequency response problems (that are amenable to correction by a filter in the first place) are the generation of comb filters generated by two signals of nearly equal level and slightly differing arrival times at the point of observation. These may be the direct sound and an early reflection, two reflections, or a multiple path early with a single path late reflection. These undesired combinations (undesired primarily because of their temporal patterning) can be narrower than 1/2 octave, especially at higher - not lower - frequencies. Remember that comb filters are evenly spaced on a linear frequency scale and thus become increasingly narrower on a logarithmic scale, which is the scale applicable to fractional octave filters. Obviously, if these narrow anomolies are linearly spaced, then you require a filter with adjustable frequencies. When comb filter anomolies are narrower than 1/6 octave, you don't require narrower filters inasmuch as 1/6 octave increments are already much, much narrower than critical bands for hearing, thus, for all practical purposes, inaudible. Used in conjunction with 1/3 octave "combining" filter sets for the overall adjustment of amplitude, 1/6 octave adjustable filters serve a useful purpose in a most efficient manner.

It is fundamental, however, to first see if the need for such devices has arisen from an arrangement of microphone and nearby reflecting surface or the loudspeaker's misalignment, etc., and making sure that simple sound system adjustment can't be made to eliminate the problem before resorting to narrow band filters. Also, basic is the other cause of narrow band effects in the system's response; namely, mechanical resonances.

We use and recommend 1/6 octave filters of this type and the above is simply a reminder that many of your competitors are "tuning" the wrong thing with incorrectly thought out filter sets. Excellent tools like this one deserve professional application skills.

ARTICLES OF INTEREST

SATURDAY REVIEW, 6/9/79, article by Isaac Asimov. Once in a very rare while another human being articulates perfectly your innermost thought on a subject. The following statement by Isaac Asimov touched such a hidden spring in us:

> *The fact is that science and technology are one.*
>
> *Just as there is only one species of human being on earth, and all divisions into races, cultures, and nations are but man-made ways of obscuring that fundamental truth, so there is only one scientific endeavor on earth -- the pursuit of knowledge and understanding -- and all divisions into disciplines and levels of purity are but man-made ways of obscuring that fundamental truth.*

In audio today, TEF™ measurements open the door for the sincere seeker to discover pure scientific effects as well as serving as a most practical everyday tool. The sheer delight of truly knowing lifts the knower into the most delightful pleasures mere mortals are privileged to experience.

****

Gordon W. Wolfe, Syn-Aud-Con graduate, brought our attention to a couple of interesting articles in the Electronics Products magazine. One was entitled *MINIATURE SPEAKERS* and appeared in their November, 1979, issue. The article pointed out how alert the Japanese are to "bend" a specification in their favor. For example, in the United States miniature loudspeakers are rated for SPL by dB/W/m. That is, the dB-SPL for one watt measured at one meter is the sensitivity given. In the identical market place, Japanese miniature loudspeakers are rated at dB/M/m which is the dB-SPL for one watt at 0.5 meter. While a not unexpected technique by those of us over 50, it might catch the younger generation off guard.

The second article was *FIBER OPTIC LINKS*. This article was also in the November, 1979, issue and contains a worth-reading "pro and con" discussion. 50 Km links with MTBF's of 60,000 hours providing EMI/RFI-immune, secure communications between computers are the current state of the art.

Articles of Interest, cont

ARTICLES OF INTEREST

In trading pyramidology with Dick Heyser, he sent us an article entitled, "A Scientist Looks at the Pyramids," written by Kurt Mendelssohn in the American Scientist, March-April 1971.

Mendelssohn's thesis is that the reign of Zoser, the first king of the Third Dynasty, was marked *by far-reaching political* and social changes. Zoser was the son of an upper Egyptian king and a princess of lower Egypt. There are many indications that Zoser's parents' marriage finally sealed the unification of the two kingdoms.

Zoser's vizier, Imhotep, is credited not only with the design of the first stone buildings but also with the first teaching of astronomy, magic (science?) and medicine. Imhotep is unique in Egyptian history as being a much venerated personality who was not a king. Imhotep built the first pyramid - the famous Step Pyramid of Saqqara.

Mendelssohn carefully develops the chronology of the great pyramids with special emphasis on the partial collapse of the pyramid at Meidum - most likely due to its own weight and shape - and how this disaster most likely was the cause of the Bent Pyramid at Dashur (altered in mid-construction as word of the Meidum collapse reached them).

Out of all this carefully developed detail comes the hypothesis that the voluntary construction of small mountains, as a way for souls to reach the Sun God, resulted in the invention of the "State."

To quote from the article,

> *As pyramid building started, a profound change had to take place in the living conditions of the population, affecting more and more people as the work proceeded. They and their families became completely dependent on the central administration which employed and fed them. At the same time, the administration must have made annual levies to obtain grain needed to supply their workers. These deliveries, too, had to* increase steadily, *until in the end an entirely new system of supply and distribution was established.*
>
> *This system, operating for a period of years, would have made a complete break with the previous isolated village economy, ushering in a basically different phase in the life of the whole country. It is quite inconceivable that after twenty years or so, when the pyramid had been completed, the Egyptian economy should have reverted to the old pattern.....The only possibility was to embark on the next pyramid at the time when the labor price on the preceding one was tapering off. Pyramid building became a necessity..... In fact, they invented "the state," a form of centralized and efficient organization which up to then was unknown to the human race.*

Today, in our own society, we are presented with pyramidial proposals such as the space race, Russian threats, government care from the womb-to-the-tomb, and we have responded "voluntarily" until the new overseers (the tax supported bureaucracy) is in the process of doing to us what happened to the ancients - economic slavery.

We recommend this article as required reading by all who would understand how the politically minded seek and acquire real power through seemingly noble projects.

BOOKS OF INTEREST

SYNERGETICS 2 by R. Buckminster Fuller in collaboration with E. J. Applewhite and published by Macmillan is volume II of his thoughts amplified and further explored. Eighty-five years young, Buckminster Fuller has been called "America's best known living genius." E. J. Applewhite has worked for the CIA as Deputy Inspector General and Chief of the Inspection Staff. He left the CIA in the late 1960's and spent five years with Fuller working on *SYNERGETICS: EXPLORATIONS IN THE GEOMETRY OF THINKING* (the first volume entitled *SYNERGETICS*).

This remarkable statement in print is worth many times its price of $27.50 for the first chapter alone, "Humans in Universe 000.100." A sample:

> *The people who make up that 99 percent* (Editor's note: those who cannot understand the mathematical language of science) *do not know that all that science has ever found out is that the universe consists of the most reliable technology. They think of technology as something new; they regard it as threatening both in terms of modern weaponry and as job eliminating competition for their life-sustaining opportunities to "earn a living." Ergo, humanity thinks it is against technology.....*

Fuller goes on to *prove* that no one need ever again to "earn a living." *Further living for all humanity is all cosmically prepaid.*

Finally,

> *Entropy is decadent, putrid, repulsive, disassociative, explosive, dispersive, maximally disordering, and ultimately expansive. Syntropy is impulsive, associative, implosive, collective, maximally ordering, and ultimately compactive.*

******

When you are sitting in the dark on a cold winter night without electricity and your wife and children ask why, you may be hard put to explain. The following quote from Robert A. Heinlein's *NOTEBOOKS OF LAZARUS LONG* may at least shed light on the mental state that brought on such a condition.

> *"There are hidden contradictions in the minds of people who 'love nature' while deploring the 'artificialities' with which man has spoiled 'nature.' The obvious contradiction lies in their choice of words, which imply that man and his artifacts are not part of 'nature'--but beavers and their dams are.*
>
> *"Such contradictions go deeper than this prima facia absurdity. In declaring his love for a beaver dam (erected by beavers for beavers' purposes) and his hatred for dams erected by men (for the purposes of men), the Naturalist reveals his hatred for his own race; i.e., his own self hatred."*

Most political questions are solved at the viseral level. Again, Heinlein provokes the thought with *"The difference between science and the fuzzy subjects is that science requires reasoning, while those other subjects merely require scholarship."*

Engineering teaches us to weigh alternatives and pick the least worse choice because the perfect answer is usually a myth. Progress does not stop, but countries have been known to stop progressing. It's the nature of the race to progress. If we think otherwise, we've been conned by someone.

CLASSIFIED

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B & K 1405 Noise Generator $1,100.
B & K 2205 SPL Meter 1" mic - similar to 2206 $800.
B & K 2204 SPL Meter modified to 2209 by B & K; 4133 1/2" mic F.F.; windscreen; 1613 octave filter set; all calibrated to N.B.S. traceablity by B & K on 6/11/79 $2,500.
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Communications Company RT-60 Digital Reverb Analyzer $400.
Dukane 1/3 octave analyzer, real-time $750.
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WANTED:
ACOUSTICAL TESTS AND MEASUREMENTS by Don Davis, hard or soft cover. Will pay the original price for a copy in good condition.
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TECH TOPICS

VOLUME 7, NUMBER 5
WINTER, 1980
Don & Carolyn Davis

EDITOR'S NOTE.....

"Speech Reinforcement in a Large Cathedral, at the Limits of D_2" was originally presented as a technical paper at the Acoustical Society of America November, 1979, meeting in Salt Lake City, Utah.

Leland K. Irvine and R. K. Fullmer are long time friends and supporters of Syn-Aud-Con. We felt this paper outlined a classic problem design in an unusually clear, straightforward manner and we are particularly interested in any design job that also measures what really happened. We believe that thoughtful study of this Tech Topic will reward the reader with an improved view of how to skip nonessential questions (for a particular design) in the design worksheet, while not failing to solve the key parameters.

In this design Q min, N, and RT_{60} are key parameters that are beautifully accounted for without compromise. The illustrations are carefully done and highly instructive.

Good Reading!

SPEECH REINFORCEMENT IN A LARGE CATHEDRAL

by
L. K. Irvine and R. K. Fullmer
Acoustical Engineers, Inc.
1864 South State
Salt Lake City, UT 84115

A state-of-the-art point source speaker system was installed in a large (627,000 cu.ft.) cathedral, with 3.5 s RT_{60}. Initial calculations using D. Davis' theory for articulation are compared with results of nonsense word articulation tests made in the building using the installed system. Also, results of octave band RT_{60} measurements are plotted, showing results of pioneering acoustical corrections performed in 1916 using covered felt blankets applied to ceiling.

This building, which is the largest Catholic cathedral in Utah, was completed in 1909. As is common with this type of building, it has seen the installation of several generations of sound reinforcement systems.

The original acoustical conditions are unknown, but must have been less than satisfactory, as we have record of a recommendation made in February of 1916 from Johns-Mansville Co. They proposed to install 13,000 sq. ft. of "Akoustikos" felt on the side walls and ceiling to correct what they termed "one of the notably bad buildings in the country". The report was clear to point out that even this bold effort would not result in "perfect acoustics," but would be as good as could be expected in so large a building!

As far as can be determined, the interior of the building is essentially the same today as it was after the completion of this work in 1916. In the process of opening the ceiling for the new speaker cluster, we were able to examine the nature of the Johns-Mansville "Acoustikos". It is similar to common felt carpet padding, approximately 1-1/2" (4 cm.) thick, which has been secured to the original plaster, which is generally about 2" (5 cm.) thick. Over the felt is a layer of canvas, which has been painted several times, rendering the surface almost impermeable. It is not known if this was the original intent. Of course, what has been produced is a very effective diaphragm-type sound absorber. The area covered by the sound treatment is approximately 13,000 sq. ft.

The reverberation time (RT_{60}) has been measured by three methods:

1. Recorded 32 cal. pistol shots
2. Recorded pink noise burst
3. Pink noise burst as analyzed by an Ivie Electronics IE-30/IE-17 combination

more.....

SPEECH REINFORCEMENT IN A LARGE CATHEDRAL, AT THE LIMITS OF D_2 by L. K. Irvine and R. K. Fullmer

The results are as shown on Chart #1. Measurements have also been made with typical audiences present (300+ persons), which has shown less than 10% effect on the overall reverberation time. In each case a pronounced dip in reverberation time is evident in the 250 hz octave band, which we ascribe to the absorption characteristics of the canvas/felt surface.

Based on the above data, and assigning a value of .19 $\bar{a}$ at 250 hz for the remaining part of the building, a value of .52 $\bar{a}$ is calculated for the canvas/felt surface, at 250 hz, which seems reasonable.

The present decay curve is certainly not ideal as it produces a lack of warmth in musical performances, which has been commented upon by the present musical director.

However, there are no plans at present for any major interior alterations.

As could be expected, there have been complaints throughout the years due to lack of speech intelligibility and it was decided to install a new speech reinforcement system.

The existing sound system consisted of 8" (16 cm) speakers hung on the side walls at approximately 12 foot spacing, with no delay or equalization. The equipment was very old and reliability was marginal. As would be expected, the intelligibility was totally unpredictable.

Several approaches were considered including pew back speakers, distributed delayed columns, a distributed and delayed array of horns, and a central cluster.

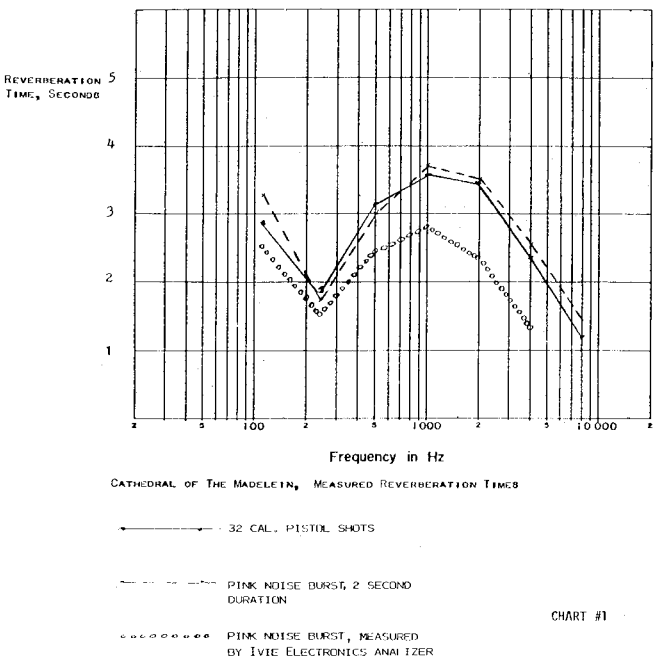


CHART #1

Due to considerations of maintaining a traditional appearance, as well as budget limitation, it was felt early in the design discussions that a central cluster should be considered if there was a reasonable possibility of it working.

Using the equations developed by Don Davis[1], based on the work of V.M.A.Peutz[2], we have the following:

Room volume - 627,908 cu. ft. (17,782 cubic meters)

Room surface - 52,432 sq. ft. (4871 square meters)

Maximum distance from proposed speaker location to farthest seat (D_2) - 156 ft. (47.5 meters)

Average RT_{60} - 500-4000 Khz = 3.14 sec.

To determine the directivity necessary to achieve a 15% maximum loss of consonants under conditions, we used:

$$\frac{641 \times D_2^2 \times RT_{60}^2}{15\ V} = Q\ (\text{min.}) \quad \left\{\text{for metric values: min "Q"} = \frac{13 \times D^2 \times RT_{60}^2}{V}\right\}$$

where:

641 = a constant

D^2 = 156 feet

RT_{60} = 3.14

15 = a constant

V = 627,908 cu. ft.

$$\frac{641 \times 156^2 \times 3.14^2}{15 \times 627{,}908} = 16.3$$

This value of "Q" or directivity would seem to be attainable with the best of the state-of-the-art horns, in a cluster utilizing 3 major horns, from:

50 max Q available

from Electro Voice HR 4020

or Altec MR 42

$$\frac{50}{3} = 16.7$$

Thus, it appeared that unless too many compromises were introduced by the actual installation, we should be able to deliver 85% intelligibility to the rear seats by a central cluster. This level of performance in dispersion control was likely not attainable in the past with horn "Q" in the 20 range and such an approach

SPEECH REINFORCEMENT IN A LARGE CATHEDRAL, AT THE LIMITS OF D^2 by L. K. Irvine and R. K. Fullmer

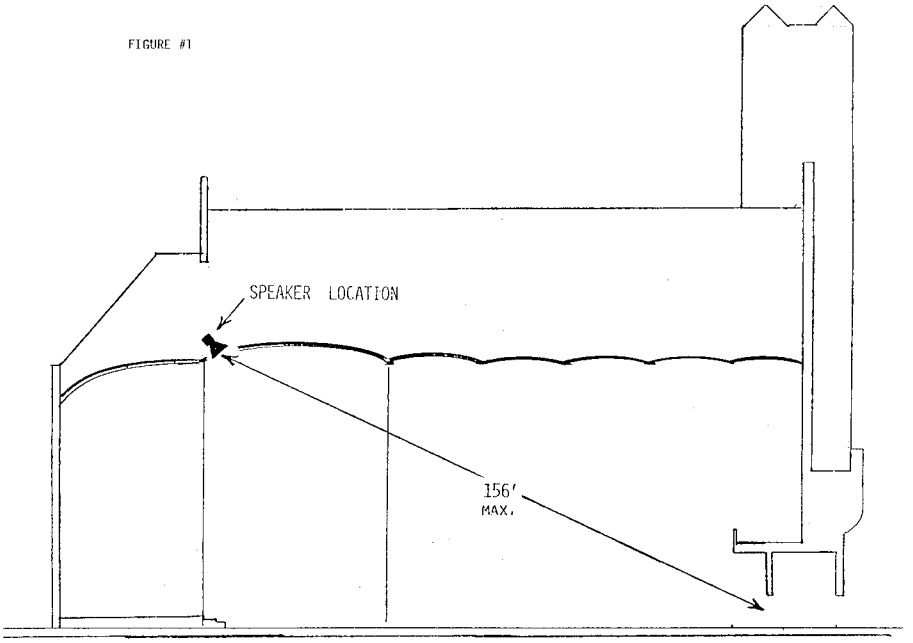
would not have been attempted. The current generation of high directivity horns gave us enough confidence to recommend the project.

A section through the centerline of the building is shown in Figure #1 with the speaker cluster located as shown. The layout of the speaker cluster is shown in Figure #2. A single line layout of the system is shown in Figure #3.

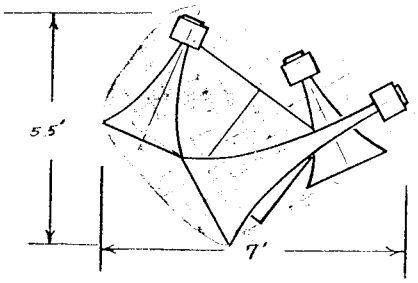
It will be noted that the system includes an IRP automatic mixer, a limiter, a 1/3 octave equalizer, and separate power amplifiers for each loudspeaker as well as a Com-Tec Wireless microphone.

Equalization was done in the reverberant field using a 1/3 octave real time spectrum analyzer, making minimal corrections, essentially to reduce two peaks by approximately 4-5 dB, at 160 Hz. and 2.7 kHz. Only very minimal (1-2 dB) tuning was done to correct for live feedback at the altar microphone.

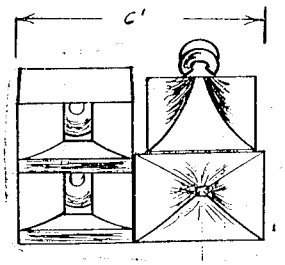
FIGURE #1



CENTRAL SPEAKER CLUSTER



SIDE VIEW



FRONT VIEW

FIGURE #2

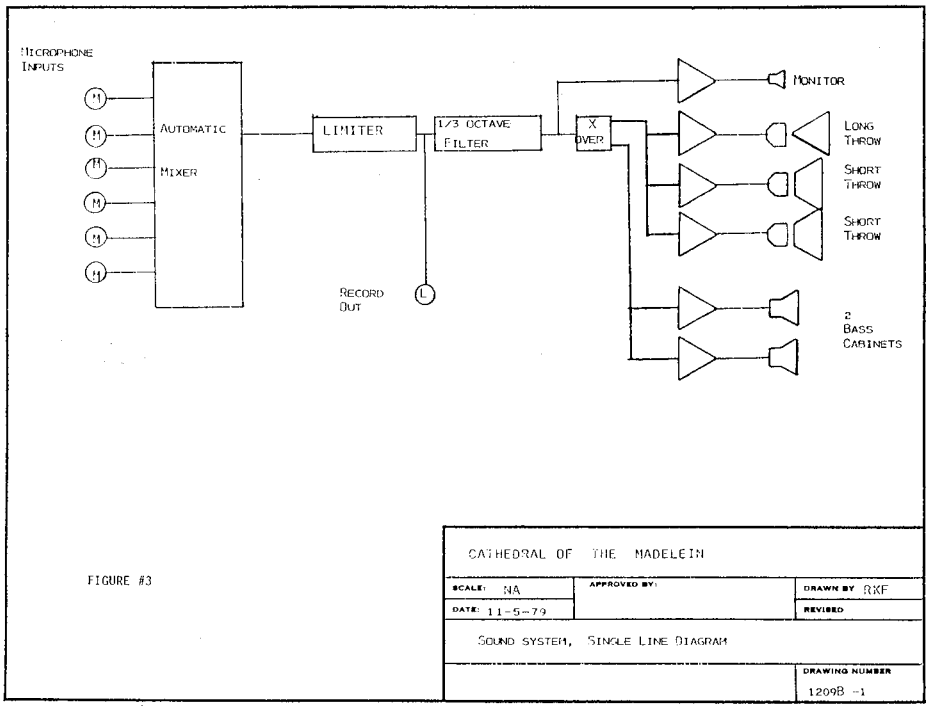


FIGURE #3

The performance of the system was as follows:

Max SPL 93 dBA at amplifier clipping, driven by pink noise.

Coverage ± 1.5 dB as measured with pink noise in 4 kHz octave band.

Maximum system gain, with source 2 ft. from microphone, 18 dB measured in 2 kHz octave band.

SPEECH REINFORCEMENT IN A LARGE CATHEDRAL, AT THE LIMITS OF D_2 by L. K. Irvine and R. K. Fullmer

A random (nonsense) word intelligibility test was conducted using a live talker at one of the pulpit microphones. The general results of this in respect to the floor plan are as shown in Figure #4, which run between 80% and 90%, which corresponds well with the predicted results.

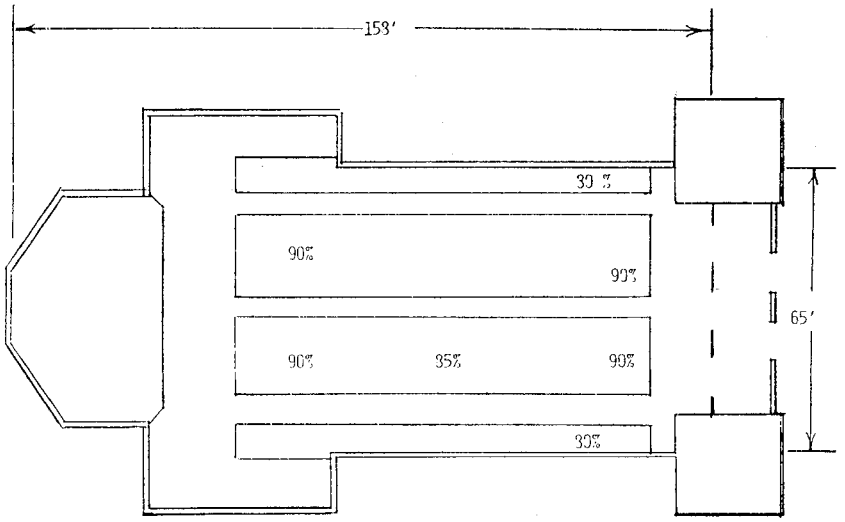


FIGURE #4

NUMBERS INDICATE RESULTS OF INTELLIGIBILITY TEST, AS PERCENTAGE OF CORRECTLY IDENTIFIED UNRELATED ONE SYLLABLE WORDS.

Speech as delivered by the system is clean and natural with a good sense of direction. Talkers, however, must be made aware of the long RT_{60} time in the room. Speech delivered in too rapid order can create difficulty.

The construction and installation of the speaker grills was not a part of the sound contract and was undertaken by the church maintenance personnel. After several weeks of apparent satisfactory operation, there were again complaints of unintelligible speech. During this time, the grill work had been installed, which we found now consisted of three layers of lightweight sheer drapery material which had been required by the firm supplying the material to achieve the correct color. Removal of the offending fabric brought things back to normal. This points up the necessity of controlling all variables when reaching for the maximum performance. The cloth material, as it was installed in three layers, was not so dense as to be totally unacceptable at first glance as lighting and some detail could be seen through it. It is, however, being replaced by the sound contractor, Spectrum West, Inc. of Salt Lake City, with a proper plastic grill fabric.

An interesting side note occurred with the choir, which is seated in an elevated loft at the rear approximately 18 feet above the floor. The main cluster was not really designed to cover this area due to concern for direct reflections off of the rear wall. However, initial tests showed quite good coverage in the choir loft, and we were surprised to hear complaints of very poor hearing from the choir members. Checking in the loft during actual usage disclosed a 10+ dB higher background noise level here due to leakage in the organ air system, which was providing a perfect masking noise. It will probably be less expensive to provide a delayed distributed system for low level coverage here than to fix the organ.

The conclusion can be drawn that the best of currently available horns based on published "Q" data are capable of delivering the calculated intelligibility, at least in this large, well diffused space.

References:

1. Davis, D., "Sound System Engineering," Howard W. Sams, pp. 70-75.

2. Peutz, V.M.A., "Articulation Loss of Consonants as a Criterion for Speech Transmission in a Room," J. Audio Engineering Society, Vol. 19, December, 1971.